

North Dakota Agricultural Experiment Station

Twenty-fifth Annual Report

To the

GOVERNOR OF NORTH DAKOTA



Agricultural College, N. D.

FEBRUARY, 1915

LETTER OF TRANSMITTAL

Agricultural College, North Dakota,

February 1, 1915.

The Honorable L. B. Hanna,

Governor of the State of North Dakota.

Sir:—As required by Act of Congress, approved March 2, 1887, I hereby submit the Twenty-fifth Annual Report of the North Dakota Experiment Station together with a financial statement of receipts and disbursements, as required by law, for the government fiscal year ending June 30, 1914.

Respectfully,

J. FRED JENSEN,

President of the Board of Trustees

North Dakota Agricultural College.

NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

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W. R. PORTER, M. S. A., Superintendent of Demonstration Farms.

The bulletins of this Station are sent free to residents of the State. Names will be entered in the regular mailing list upon request.

*Detailed to North Dakota Experiment Station by the United States Department of Agriculture.

REPORT OF THE DIRECTOR

THOMAS P. COOPER

To the Board of Trustees of the North Dakota Agricultural College and Experiment Station.

Gentlemen:

The Twenty-fifth Annual Report of the North Dakota Agricultural Experiment Station covering the work encompassed by said Station from January 1, 1914, to July 1, 1914, together with expenditures and receipts for the fiscal year ending June 30th, 1914, is herein submitted. The preceding report of the Agricultural Experiment Station covered the calendar year 1913. It has been deemed advisable to close this report on the date July 1, 1914, in order that future reports may coincide with the fiscal year of the institution and with the biennial and other reports required.

During the year few changes have been made in the work of the Experiment Station. The changes made have served to more definitely outline the research projects and to separate the research work from that of teaching and extension. As far as possible, men now on the scientific staff have been assigned to experimental projects which require their full time. These men are not concerned in either teaching or extension activities. It is believed that such separation of research and teaching work will increase the efficiency of the scientific staff and assure a grade of research work that cannot otherwise be obtained. For the purpose of administration, the Heads of Departments are employed in a dual capacity to administer the research work as well as that of education. The research projects have been so rearranged as to permit the application of the entire time of a man to a single project, or at most to two projects.

The work of the Experiment Station and of its Sub-Stations as planned for the next two years is chiefly along agricultural and kindred economic lines. The development of agricultural thought and practice by means of the agricultural field agent has brought to the Station new and pressing problems which require solving before wrong practices become fixed. A continuous association of the workers in a research institution with those engaged in the field force will bring the institution more closely into contact with the farmer's problems, and will encourage a systematic development of research work to meet the demands of the farming population and to solve the problems by which they are confronted.

It is the duty of an Agricultural Experiment Station to investigate and determine the agricultural facts fundamental to farm progress and to the welfare of the rural population. In consequence, it is believed that the work of the Experiment Station in the immediate future should be upon the farm management and agricultural problems which have to do with the new form of agricultural practice developing in North Dakota. The one crop farmer is passing and the diversified farm is developing. Problems

of efficient forage and grass crop production, the development of superior varieties of early corn and other feed crops, methods of livestock production suited to existing conditions, and systems of farm management which will enable the land owner to meet the demands of the changing practices, must be solved.

The farmer of today recognizes more clearly than ever before the necessity of co-operation, the need of community development, and of a more exact knowledge of distribution, markets and of adjustment to the rapidly changing economic conditions. It therefore follows that a research institution should, as rapidly as possible, attack the problems that affect the economic basis of farm life.

RESEARCH WORK OF THE EXPERIMENT STATION

In the following pages a brief statement is made of the more important lines of research in progress at the Experiment Station. No attempt is made to cover all projects under way, nor to fully discuss those presented. As rapidly as the results of research and trials justify, they are published in bulletin or circular form, detailing the experiment and its application.

SOIL SURVEY

The work of the Geological Survey has been placed with the Division of Soils, as by this means it may be more closely related to the soil work of the Experiment Station. Complete soil surveys of co-operating counties will be continued jointly by the North Dakota Agricultural Experiment Station and the Bureau of Soils of the Department of Agriculture. These surveys will be developed in detail, and special attention will be given to the relation of soil type and the crop producing power and future agricultural possibilities. During the coming year it is expected that the survey of LaMoure County, which has been partially completed, and that of Dickey County will be finished. The work requires the services of three men from the Experiment Station and that of an equal number from the Bureau of Soils.

Accurate soil maps and surveys treating in detail of the agricultural conditions and possibilities of each forty-acre tract, as planned under this work, are of great importance to the state. They form the basis of a definite knowledge of a fundamental factor in crop production. The incoming settler or the investor may obtain from the soil survey definite information as to the type of soil and subsoil, and the soil class type of any forty-acre

tract that has been surveyed. Eventually the soil survey may become the basis for fixing the value of real property and of equitably distributing the tax levy on a basis of real land value.

TUBERCULOSIS OF POULTRY

The work on avian tuberculosis begun in 1913 has been concluded, and Bulletin 108 published detailing the results. Tuberculosis is prevalent in many farm flocks of poultry. Its presence is finally indicated by losses in weight and many deaths. This experiment has developed a simple and effective method of determining the presence of tuberculosis in fowls. If the disease is shown by tests, precautionary measures may be taken and flocks freed in much the same manner as that employed in eradicating tuberculosis from a herd of cattle.

SERUM DISTRIBUTION

By legislative act, a Serum Institute for the manufacture and issuing of preventive hog cholera serum, mallein and tuberculin, was established in 1909. The sum of \$3,000 annually was appropriated for this purpose. This fund is entirely inadequate to meet the demands made for free hog cholera serum, mallein and tuberculin. The occurrence of several extensive outbreaks of hog cholera made it advisable to arrange some method by which a supply of serum could be made available to those requesting it.

In planning the hog cholera work for the current year, funds were borrowed for the purchase of serum in large quantities. The funds of the Serum Institute are to be used for the testing, bottling, labeling and shipment of the serum. All serum is bought in bulk, subject to test upon arrival. The Station prepared serum on hand is mixed with the commercial product and the mixture again tested. All serum purchased will be sold at cost, or as much below cost as the inter-mixture of the Station serum will permit.

It is believed that this method of handling the serum will be found satisfactory and that purchasers in the state will in this way be assured of a tested and efficient product at the lowest possible price. By this method the funds supplied by the legislature will permit the distribution of large quantities of serum without the loss and expense incident to manufacture.

During the year 1913, one thousand forty-nine issues of mallein and tuberculin were made, and two hundred eighty-three issues of hog cholera serum.

SWAMP FEVER

The investigation of swamp fever in horses has progressed slowly, owing to the lack of fresh material upon which to work and to the difficulties peculiar to the problem. With better material secured the latter part of the fiscal year, the experiments will be pushed vigorously. The results strengthen the belief that methods of diagnosing by means of immunity reaction which have been used in other diseases are not applicable to swamp fever.

INVESTIGATIONS IN HOG CHOLERA

The investigations in hog cholera have been continued. Two phases of this investigation have been attacked. First, the preparation of immune serum, with a view of clearing up, if possible, the difficulty experienced during the previous year. The results of tests indicate that while the degree of serum potency varies in the different samples, yet all of the serum products were potent. The causes of such variation in potency are also varied and as yet not definitely worked out.

Second, attempts were made to demonstrate the presence of antibodies by the application of certain immunity reactions. Some progress was made, but the small number of observations, as well as a lack of confirmatory evidence, render more specific statements inadvisable at this time. Work is being continued along this line of investigation.

HORTICULTURAL WORK

The horticultural work carried on has dealt principally with cultural methods and plant improvement as related to conditions prevailing in the state. Especial attention has been given to tomato production. The experiments include dates of seeding, time of transplanting, methods of growing, training, root pruning and cultivation. In the variety test and breeding work, eighty-seven varieties and one hundred twenty-two strains were used.

The possible importance of the tomato as a profitable crop is indicated by the fact that good strains produce as high as 1,000 bushels per acre in the vicinity of Fargo, while the poorer ones may produce 500 bushels or less. During the past two years, two or three small canning factories have been established to make use of the tomato crop. This industry will undoubtedly develop with the increasing density of population. The Experiment Station is now working on varieties and strains of tomatoes which seem destined to prove valuable in this section of the state.

Work on fruits has been continued along lines referred to in previous reports. The disease of fire blight upon apples was so destructive as to practically annihilate some of the more susceptible varieties. The Hibernial was the only variety of apple not seriously affected by the blight.

RODENT CONTROL

A co-operative arrangement was effected with the Biological Survey of the U. S. Department of Agriculture, for a study of methods of control and extermination of ground squirrels, pocket gophers, prairie dogs and other rodent pests occurring in the state. In many sections of the state, the ground squirrel is a serious pest, consuming or devastating large acreages of wheat, corn and alfalfa. The annual damage from rodents is estimated at one and a half millions of dollars. A number of counties have attempted remedial measures either through the bounty system or by the distribution of poison. Generally the lack of systematic endeavor or the ineffectiveness of the methods used has resulted in partial instead of complete control of these pests. The work planned by the Station contemplates a careful investigation to determine economic and effective methods of extermination.

CROP ROTATION

A large number of plots on the farm are devoted to a study of the various systems of cropping and of crop rotation. The results obtained from systems of cropping which include a cultivated crop, a leguminous crop and a pasture crop, with small grain not to exceed one-half of the years, indicate the value of a rotation under the prevailing conditions. Each succeeding year shows the advantages which may be obtained from systematic rotations and their importance to the farm operations of the State. Wherever trials are carried out, they indicate that a crop rotation returns approximately sixty per cent greater income than systems of continuous culture. In connection with the rotations based upon a crop sequence, trials have been carried on to determine the importance or necessity of livestock farming. The evidence accumulated shows that systems of farming in which livestock is strongly correlated with grain production give better immediate returns and retain the productivity of the land to a greater extent than systems based upon grain production.

MANURES AND FERTILIZERS:

A fertilizer experiment in which the various mineral fertilizers that contain the elements essential to plant growth are used, has been instituted. A series of plots with a number of checks has been laid out to test definitely the results which may be obtained from the use of commercial fertilizers

and to indicate the elements that may be lacking in the soil at the present time. These trials are duplicated at the Edgeley and Langdon Sub-Stations, and in time will furnish definite information as to what may be expected on these soils from the use of fertilizers.

Another trial has for its purpose a comparison of the use of fresh stable manure with composted manure. Results to date indicate that fresh manures in this section should be applied to land which is to be devoted to gross feeding crops, such as corn, millet and the grasses, during the season following application.

LEGUMINOUS CROPS:

Red clover has become one of the standard crops in the rotation and is giving excellent results. Field trials of alfalfa have demonstrated its reliability for forage production under the conditions prevailing in the Red River Valley, and it should become one of the crops in the standard long time rotation system adopted in this section. The alfalfa crop on the Experiment Station Farm in 1914 yielded a total of four and five-tenths tons per acre from two cuttings. One field gave a yield of seven and four-tenths tons from three cuttings.

GRAIN CONTINUOUSLY:

Plat Two in the rotation series has produced a crop of wheat annually since 1882. This plat has received no fertilizer of any character since it was broken as virgin prairie. There is strong evidence that the soil fertility of this plat has not been exhausted by the continuous cropping, although it is seriously affected by seasonal handicaps, and the yields have averaged from two to twenty-four bushels less than those obtained under rotation. The spread in yield between Plat Two and the rotated plots has been much greater during the last half of its cropping history. This plat will in the future enable the investigator to obtain much definite information relative to changes occurring in the essential elements of fertility and will furnish basic facts covering the problem of soil exhaustion.

TILLAGE TRIALS:

Tillage experiments to determine the effect of the depth of plowing are being continued. The accumulated evidence indicates that with Red River Valley soils, when costs are taken into consideration, no advantage is obtained by plowing ten, twelve or fourteen inches deep over good, seven inch plowing.

As the lands become older, the disadvantage of summer fallowing is being emphasized. The increased yields resulting from fallowing are steadily decreasing. This may be due to several factors, prominent among which are the exhaustion of humus and a poorer physical condition of the soil.

PLANT BREEDING

The plant breeding projects in progress are being continued. It is planned to materially decrease the strains and varieties carried during nineteen hundred fifteen. Extensive trials covering a number of years have shown possibilities of elimination that will enable greater attention to be given to the prospectively more valuable strains. In addition to the rather extensive work in cereal breeding, attention is being given to potato breeding by hill selection, and to pedigree records of hill and row production. This trial covers a limited varietal study and is confined chiefly to the few standard types.

Breeding for hardy and productive strains of clover has been continued in co-operation with the Bureau of Plant Industry. The progress made is very encouraging and gives promise of excellent results in clover production in the east one-third of the state.

Work with soy beans is continued. This plant is being selected for earliness and for oil yield. The foundation stock is of Japanese and Manchurian origin. The strains now produced on the Station plots show much earlier maturity than do the varieties commonly secured on the market. The work has advanced far enough to indicate that this crop has possibilities in this region.

Alfalfa breeding for hardiness and productivity is being continued. Hardy and tender strains are being differentiated by this work.

A preliminary trial with sweet clover is in progress, primarily for the purpose of selecting valuable strains.

FARM MANAGEMENT

Studies in Farm Management are carried on co-operatively with the Office of Farm Management of the Department of Agriculture.

These studies are along the following lines:

- (a) The seasonal distribution of farm labor.
- (b) The cost of producing agricultural products.
- (c) The use of farm manures and losses in composting and application.
- (d) A study of successful farm operations as developed by the best farmers in the state.

CARRYING CAPACITY OF PASTURES

Several years' trials are in process of completion showing the relative carrying capacity of the various grass pastures. These trials have been conducted with cattle, sheep and horses, and indicate the acreage of pasturage required for the different classes of stock, also which grasses give best results.

ANNUAL PASTURES

A series of tests in pasturing hogs on oats, sweet clover, rape and winter rye for spring and fall pasture is in process of completion, and the results will be published the coming year. Trials have also been conducted in the "hogging off" of corn of both flint and dent varieties, and of field peas and corn. The results of this method of feeding have been extremely encouraging. By "hogging off" corn and using annual pasture crops, the land can be made to return in pork a value of from \$12 to \$30 an acre.

SOIL STUDIES

Progress has necessarily been slow in the Station soil studies. Much preliminary work has been accomplished with regard to special studies of straw rotting, nitrification, plant nutrition, and the use of basic slag as a carrier of phosphorus. A study of weeds and their draft upon the fertility of the soil has been completed and is now in process of compilation.

ANALYSIS OF SUGAR BEETS

A large number of trials have been made by farmers, the Sub-Stations and Demonstration Farms, as well as at the Experiment Station, in the production of the sugar beet. Samples of the product have been analyzed at the laboratory to determine the sugar production of beets in North Dakota. Data obtained from the trials show a relatively high percentage of sugar in beets. The average percentage of sugar from three hundred and eighty-three trials was 14.9 per cent, with a purity coefficient of 82. The quantity of sugar in beets grown in the northwestern part of the state on the Williston Sub-Station was exceptionally high, averaging about 20 per cent.

FEEDING VALUE OF CORN AT ITS DIFFRENT STAGES OF GROWTH

A trial was commenced during the year to determine the feeding value of corn at the different stages of growth. This trial will show the increase in dry matter and the feeding value of the corn plant during its various growing stages, and will furnish a basis upon which to decide varietal values and the best stages for harvesting corn.

STUDIES OF MILLING VALUES OF WHEAT

A great variety of work has been carried out with the milling of wheats and studies of flour production. A study of the milling value of the types of wheat as produced upon the State Demonstration Farms has been completed. This investigation has been for the purpose of determining the effect, if any, upon the quality of wheat grown under a systematic rotation.

Data covering a series of years of test is being completed which indicates that certain changes in the present system of grading grains would be advisable. Changed conditions and values have brought about a relatively smaller margin between the actual value of the lower grades of wheat and the higher, than is generally supposed. The preliminary tests indicate that the local mills may use a percentage of the lower grades of wheat and improve their output with regard to loaf value and quality of bread produced.

Other studies are in progress which are designed to determine to what extent, if any, sprouted wheat deteriorates, or to what extent sprouting injures the quality of the flour produced from such wheat.

Milling and baking tests of Durum, Marquis, Velvet Chaff, and other new varieties or strains have been continued, and a comparison of these wheats with the standard fife and bluestem has been made.

PAINT, OIL AND VARNISH STUDIES

Studies in paints are being carried on to determine the best productive coatings to be used on galvanized iron. Some promising results have been secured. Other studies are to determine the effect of emulsifiers in paint, the extent, if any, that several types of emulsifiers tend to injure the wearing quality of paint, and to ascertain the extent to which emulsifiers are employed.

The trials in practical paint work begun in 1906 have been finished. The results indicate that ochre has not been a satisfactory priming coat

and that the addition of water to paint has in every instance proved a detriment and injury to the wearing quality of the paint.

A new and accurate method of varnish analysis has been developed in the laboratory in connection with special studies in regard to varnish products.

ROOT DISEASES OF WHEAT

Experiments to determine possible causes and methods of combatting the root and seed diseases of wheat are being continued. This project has special reference to those diseases which may result from the development of certain fungi in the soil which attack following crops of wheat.

FLAX DISEASES

The diseases of flax, particularly wilt, are of such nature that when once introduced into the land, they make the soil almost barren so far as flax production is concerned. Canker and one or two of the other seed boll destroying fungi, as well as rust, have also become destructive in the past few years. All of the flax diseases which are particularly destructive, owe their derogatory powers chiefly to the fact that the disease accumulates in the soil. They are parasitic in their ability to attack flax roots. New land or land that has not previously grown flax may become infected with these diseases by means of infected seed, straw or manure. After infection, flax cropping cannot be successful until it is cleaned of the disease, unless resistant seed can be obtained.

The investigations of flax diseases have been planned on two principal lines. The first is especially for the purpose of determining the nature of the seed and root infecting diseases of the flax crop and their systematic relation to cropping methods. The second consists in co-operative work designed to gather general information upon farm conditions and upon the results from the application of the methods developed in the investigation to the commercially operated farm. In this connection, plans have been made for the establishment and inspection of flax plots for the breeding of resistant varieties. Four flax varieties have been distributed and are being extensively grown.

ACTIVITIES OF THE MICROORGANISMS OF THE SOIL

The investigation of the factors affecting activities of soil flora under continuous cropping and rotation systems has been suspended. Results obtained during the previous study at the Station indicate that the methods

followed and the physiological tests commonly in use are of questionable value. For the reasons stated, it has been necessary to start a line of investigation to determine certain fundamental factors underlying the activity of soil organisms.

Further studies are in progress to determine the ammonifying power of certain ammonifying organisms upon known nitrogenous compounds, both in the presence and in the absence of a soluble carbo-hydrate. The determination of the effect of known beneficial bacteria upon available plant food is also being studied. These investigations are expected to offer fundamental facts upon which to base practices of soil improvement.

CAUSE OF RESISTANCE OF FLAX TO WILT

The question has arisen as to the causes of resistance or non-resistance of flax to wilt. It is known that some varieties and strains of flax have a greater resistance to the disease of wilt than others. The basis of this resistance and its application to similar problems is, however, unknown. Preliminary experiments are in progress to test the possible enzymic difference which may account for the variation noted between resistant and non-resistant strains of flax.

POTATO DISEASES

During the past two years, Rhizoctonia, Fusarium Wilt, Potato Scab, and the early and late blights have become more or less common in the potato growing sections of the state. Fusarium wilt is common enough in many sections to be a source of danger to the future of the seed industry. Studies designed to establish methods of control of potato diseases with special reference to those affecting the tuber have been started. Three general lines of investigation are being conducted: (a) Field trials in crop rotation and methods of control, (b) Mycological and histological studies of causal organisms and host, and (c) A survey of the infected areas of the state.

PURE SEED LAW

The work of the seed laboratory established at the North Dakota Experiment Station by legislative act in 1909 has continued to develop in accordance with the statutory provisions. During the past year the chief attention has been given to seed analysis and to inspecting such field plots of pedigreed seeds as applications from growers demanded.

During the current year, five thousand five hundred and seventy-seven samples of seed were examined in the laboratory. Of the total number, two thousand one hundred and forty-one samples were submitted for germination and purity tests.

The percentage of purity of the various kinds of seeds received and the approximate purity of the sample is indicated by the following table:

NUMBER OF SAMPLES AND APPROXIMATE PURITY

Kind of Seed	99 to 100%	98 to 99%	95 to 98%	90 to 95%	80 to 90%	70 to 80%	60 to 70%	Be- low 60%
Alfalfa.....	176	65	60	30	20	3	1	2
Barley.....	76	24	23	10	2	0	0	0
Bluegrass, Ky.....	1	0	1	7	11	5	0	0
Bromegrass.....	0	2	9	38	124	64	20	5
Clover, Alsike.....	0	3	0	2	4	1	0	0
Clover, Red.....	21	11	20	12	8	1	0	0
Clover, Sweet.....	8	7	10	10	3	0	1	0
Clover, White.....	1	6	9	6	4	0	0	0
Flax.....	62	35	57	27	11	2	4	1
Millet, Common.....	25	16	30	14	11	6	3	0
Millet, Broomcorn.....	9	5	4	0	0	0	0	0
Oats.....	71	25	29	5	4	0	0	0
Redtop.....	0	0	3	5	2	4	2	0
Rye.....	7	8	6	2	0	0	0	0
Timothy.....	28	49	67	28	6	3	0	1
Wheat, Common.....	212	65	49	17	1	0	0	0
Wheat, Durum.....	0	8	10	14	12	7	1	0
Wheat Grass.....	2	1	3	11	12	6	2	1

These represent various conditions of seed, many being uncleaned, thus accounting in large part for the low figures. The difference between the common and Durum wheat is due to the admixture of common wheat in Durum. This was present in less than .1% in only eight samples; in the remainder the average was slightly over 4.0%, the maximum being 20%.

The germination percentages are presented in the following table in the same manner:

NUMBER OF SAMPLES RECEIVED OF A GIVEN GRADE OF GERMINATION

Kind of Seed	98 to 100%	95 to 98%	90 to 95%	80 to 90%	60 to 80%	40 to 60%	Be- low 40%
Alfalfa.....	1	8	27	78	154	78	36
Barley.....	72	54	13	3	3	3	1
Bluegrass, Ky.....	0	0	4	4	11	6	0
Bromegrass.....	16	83	101	41	12	5	1
Clover, Alsike.....	0	0	3	4	4	0	0

Clover, Red.....	0	2	8	29	27	6	0
Clover, Sweet.....	0	3	2	3	13	13	5
Clover, White.....	0	1	1	10	12	2	0
Corn.....	63	80	63	49	52	22	25
Flax.....	62	45	50	30	22	2	1
Millet, Common.....	1	28	26	27	15	5	4
Millet, Broomcorn.....	3	4	6	6	2	0	0
Oats.....	56	55	25	9	3	1	2
Redtop.....	0	3	6	3	4	0	0
Rye.....	4	10	6	6	0	0	0
Timothy.....	31	75	42	26	6	1	1
Wheat, Common.....	148	123	56	21	3	0	1
Wheat, Durum.....	5	8	18	19	2	0	1
Wheatgrass.....	8	16	12	2	0	1	0

In the preceding table the germination of the clovers and alfalfas is exclusive of hard seed, the amount of these being shown in the following table:

NUMBER OF SAMPLES RECEIVED OF A GIVEN
GRADE OF HARD SEED
SIX DAY TEST

Kind of Seed	0 to 5%	5 to 15%	15 to 25%	25 to 50%	50 to 75%	Above 75%
Alfalfa.....	37	77	82	142	34	5
Clover, Alsike.....	3	4	3	1	0	0
Clover, Red.....	9	34	19	10	0	0
Clover, Sweet.....	6	9	8	7	8	1
Clover, White.....	3	8	6	0	---	0

The four weed seeds prohibited by law were found in the sample as follows:

NUMBER OF SAMPLES RECEIVED WHICH CONTAINED
PROHIBITED SEEDS

	Alfalfa	Blue-grass (Canada)	Brome-grass	Clover (Alsike)	Clover (Red)	Clover (Sweet)	Clover (White)	Flax	Lawn-grass	Rye	Timothy	Wheat	Wheat- grass	Total
Quackgrass.....	....	....	64	....	1	....	....	....	....	1	2	....	1	69
Canada Thistle	1	2	....	....	2	3	1	1	2	....	22	....	....	34
Sow Thistle	....	....	....	1	....	....	....	....	....	....	5	....	1	7
Dodder.....	65	....	....	....	2	....	....	....	....	....	....	....	....	67

Chaff of quackgrass was also found in 22 additional samples of bromus. The presence of Canada thistle in sweet clover of foreign origin is of special interest, this being a new source of danger from this weed.

The seeds of quackgrass appear from practically all parts of the state, those of Canada thistle and sow thistle chiefly from the northeastern counties.

Samples of seed collected by inspectors from dealers in the state during the months of March, April and May, 1914, were as indicated in the following summary:

SEED SAMPLES COLLECTED BY INSPECTORS FROM
DEALERS

	Kind of Seed Number of Samples	Number Containing Seeds of Prohibited Weeds	Number Germinating less than 40% and Declared Illegal	Number Ordered Labeled "Uncleaned"
Alfalfa.....	37	2	1	2
Barley.....	12	0	0	7
Bluegrass, Canada.....	5	3	1	0
Bluegrass, Ky.....	18	0	1	0
Bromus.....	18	4	0	1
Buckwheat.....	7	0	1	0
Clover, alsike.....	8	0	1	3
Clover, Red.....	27	1	1	8
Clover, Sweet.....	3	1	0	0
Clover, White.....	12	1	0	0
Cane.....	4	...	0	...
Corn, Field.....	177	...	10	...
Corn, Pop.....	1	...	0	...
Corn, Sweet.....	15	...	0	...
Emmer.....	2	0	0	0
Field Peas.....	6	...	0	...
Flax.....	10	0	1	2
Kaffir Corn.....	2	...	0	...
Lawngrass.....	53	19	...	...
Meadow Fescue.....	1	0	0	0
Millet, Broomcorn.....	18	0	0	4
Millet, Common.....	83	0	8	21
Millet, Japanese.....	2	0	0	0
Oats.....	9	0	0	3
Perennial ryegrass.....	2	0	0	0
Rape.....	11	...	1	...
Redtop.....	12	0	0	1
Rye.....	3	0	1	0
Sheep Fescue.....	1	0	1	0
Slender Wheatgrass.....	12	0	0	0
Sorghum.....	1	...	0	...
Timothy.....	43	0	0	5
Timothy and Alsike.....	2	0	0	0
Wheat.....	25	0	0	5
Vetch.....	1	0	1	0
Total.....	743	31	29	62

DEMONSTRATION FARMS

Three of the farms, Ayr, Bismarck and Starkweather, respectively, were discontinued in the spring of 1914; the first because it was located in Cass County, the county in which the main Experiment Station is located; the second because it is within a few miles of the new Government Experiment Station at Mandan; and the third was discontinued because the managers did not show the proper attitude toward the work, particularly in regard to the production of alfalfa.

The rotations on these different farms have been carried out the past season as they had been previously planned, except where it seemed desirable to make minor changes. Sweet clover was seeded on three farms, namely, Granville, Beach and McLeod. At these points good stands were obtained. The land at two of these points is light and sandy in character. Alfalfa was seeded with a nurse crop on nine farms, the seed being mixed with the small grain and seeded at the regular time for such seeding. On six of these fields, namely, Hoople, Hazelton, Beach, Mohall, Ross and Sanborn, good stands were obtained by this method.

Winter wheat produced a crop at New Salem and McLeod. At both places it had been planted in corn and the stalks were left standing. The stand of wheat in each case was about one-half winter killed. At all other points where winter wheat was planted, it winter killed. These experiments have been conducted for six years by seeding winter wheat on fallow land, in grain stubble and in standing corn. In a few cases when snow came early, the wheat produced a good crop. It can now be definitely stated that winter wheat is not successful as a farm crop in this state even when given so favorable a place as seeding it in standing corn would represent. To seed it in standing corn, a one-horse drill was used and the corn stalks were left standing to catch the snow.

Demonstration Farm meetings were held on thirteen of the farms during the past season. These were attended by approximately 1,300 people, who were shown the plots, after which the rotations were discussed, as well as other topics directly relating to better agriculture. At the meetings this year a woman speaker talked to the women while the men were going over the demonstration farm plots.

The alfalfa planted in rows for seed production has done well in most cases. At Mohall, where sixteen acres are seeded in this way, the season was too wet for seed production, but three crops of hay were harvested, which yielded approximately four tons per acre. Good seed crops were obtained at New Salem, Carrington, Rugby, Lakota and Bathgate.

The office of Assistant Superintendent has been discontinued, and the Field Agents have assisted in counties where they are located. This has resulted in a considerable saving in the expense of operating the farms.

During the past year, the twenty-three farms have cost approximately \$8,000, or \$348 per farm including McLeod. If McLeod is excepted, the cost of operating each farm is approximately \$300.

At Larimore, all the data from pasturing and feeding the livestock on the manager's farm, which included approximately sixty head of beef cattle, one hundred sheep, and thirty to fifty hogs, is obtained. Next year it is planned to get data on "hogging off" corn on the different demonstration farm fields.

Corn on the Demonstration Farms averaged over thirty bushels and, wheat 18.24 bushels, or exactly 60 per cent above the average for the state. This is approximately what it has been for the past five or six years. Oats, barley and alfalfa have all produced well. At McLeod the past season the alfalfa did exceptionally well, yielding an average of 4.2 tons per acre in three cuttings. Other crops did not do well on account of the excessive amount of rainfall in the early part of the season. Ten acres of new alfalfa were seeded, also considerable sweet clover and red top, all of which made a fair stand. The greater portion of this farm will be seeded to alfalfa, red top, corn and oats.

SUB-STATIONS

Reports of the work in progress at Edgeley, Dickinson, Williston and Langdon Sub-Stations have been published as separate documents. On account of financial difficulties it has been thought best not to publish a separate report of the Hettinger Sub-Station. The Hettinger Sub-Station is being operated chiefly as a demonstration farm. A herd of dairy cows is maintained there, and so far as possible the farm is operated to show the relationship of livestock to farm practice in that territory. The experimental work as carried on requires approximately one-quarter of the farm and one-half the funds.

During the coming year or two, plans have been made to redirect the activities of the Sub-Stations so that more attention will be given to livestock problems. A few lines of crop work will be discontinued in order to provide ground for the production of feed crops.

ENFORCEMENT OF FOOD AND DRUG LAWS

The report of Food Commissioner covering the enforcement of the Food, Drug and Beverage laws has been embodied in a separate publication. It is made the duty of the Experiment Station to enforce the various provisions of the Food, Drug and Beverage laws.

BROME GRASS FIELD INSPECTION

The difficulty in securing brome grass seed free from quack grass induced the Experiment Station to provide for the inspection of all brome grass fields where application for inspection was made. During June and early July, a total of thirty-three fields, having an area of 1,000 acres, were examined in various sections of the state. Nine fields (290 acres) were sufficiently infested with quack grass to make it inadvisable to save seed from them. The total yield of the fields believed to be free from quack grass were estimated by the inspector at 64,000 pounds.

PUBLICATIONS

The following bulletins and circulars have been issued during the past year.

- Bulletin No. 105: August, 1913. "Windmill Electric Lighting and Power." by Wallace Manikowske.
- Bulletin No. 106: October, 1913. "(1) The Fertility Constituents of Flax, by J. W. Ince. (2) The Feeding Value of Flax Material, by J. W. Ince. (3) The Distribution of Prussic Acid in the Flax Plant, by J. W. Ince. (4) Influence of Bran Extract on the Baking Quality of Flours, by H. L. White. (5) Phosphorous Content of Wheat and Flour and Its Relation to the Baking Qualities of Flour, by H. L. White and R. F. Beard."
- Bulletin No. 107: December, 1913. "Wheat: Soil Troubles and Seed Deterioration, Causes of Soil Sickness in Wheat Lands, Possible Methods of Control, Cropping Methods with Wheat," by H. L. Bolley.
- Bulletin No. 108: April, 1914. "Avian Tuberculosis," by L. Van Es and A. F. Schalk.
- Circular No. 1: May, 1914. "Flax Cropping, Harvesting Methods," by H. L. Bolley and M. L. Wilson.

FINANCIAL STATEMENT

UNITED STATES APPROPRIATIONS, 1913-1914

RECEIPTS

Hatch Fund	Adams Fund
\$15,000.00	\$15,000.00

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1914, under acts of Congress approved March 2, 1887, (Hatch Fund) and March 16, 1906, (Adams Fund).....	\$15,000.00	\$15,000.00
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DISBURSEMENTS

Salaries.....	10,924.10	10,511.80
Labor.....	3,471.60	1,467.70
Publications.....		
Postage and Stationery.....		12.85
Freight and Express.....		128.28
Heat, Light and Water.....		36.80
Chemical Supplies.....	23.29	352.78
Seeds, Plants and Sundry Supplies.....		65.53
Fertilizers.....		
Feeding Stuffs.....		383.02
Library.....		4.97
Tools, Implements and Machinery.....	268.81	174.10
Furniture and Fixtures.....	142.20	104.00
Scientific Apparatus.....	150.00	444.00
Live Stock.....		1,178.52
Traveling Expenses.....		22.90
Contingent Expenses.....	20.00	
Building and Improvements.....		112.75
Total.....	\$15,000.00	\$15,000.00

